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Total No. of Questions : 09] [Total No. of Pages : 03

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B.Tech. (Semester - 4th)

SIGNAL AND SYSTEMS (EC - 206)

Time : 03 Hours Maximum Marks : 60

Instruction to Candidates:

1) Section - A is **compulsory.**
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

Section - A

Q1) *(10 x 2 = 20)*

a) Show that the phase spectrum of a periodic signal is antisymmetrical about the vertical axis passing through the origin.

b) State Dirichet's conditions.

c) Determine whether the given function is periodic or not. In case it is periodic, find the period.

$2 \cos t + 5 \sin \sqrt{2}\, t.$

d) If the Fourier transform of $f(t)$ is $f(w)$, obtain the fourier transform of $f(t) \sin w_o t$.

e) Distinguish between a continuous random variable and a discrete random variable.

f) Define ergodicity of a stochastic process.

g) A box contains 2 white, 3 black and 4 red balls. Three balls are drawn in succession. What is the probability that they are of (i) different colours (ii) same colour.

h) State convolution theorem.

i) What is a matched filter?

j) Define thermal noise and shot noise.

P.T.O.

Section - B

(4 x 5 = 20)

Q2) Find the trigonometric fourier series of the waveform shown in Fig. 1. Plot the frequency spectrum.

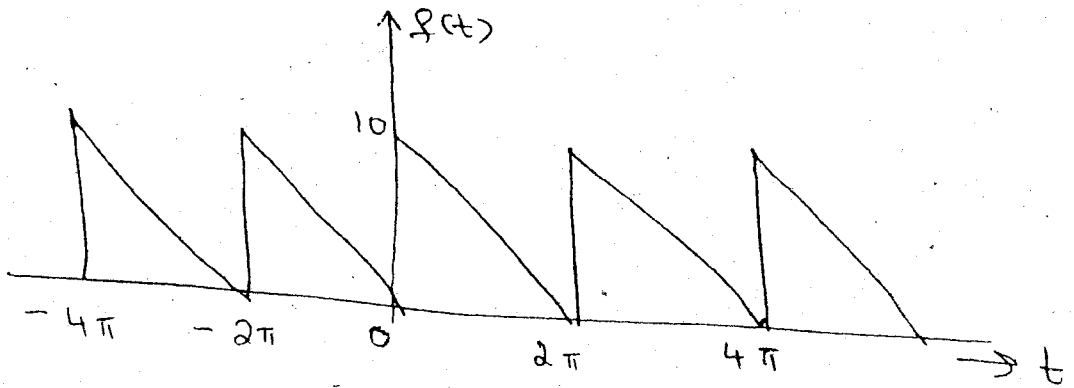

Fig 1

Q3) State and prove the time differentiation theorem and hence use it to find the fourier transform of the waveform shown in Fig. 2.

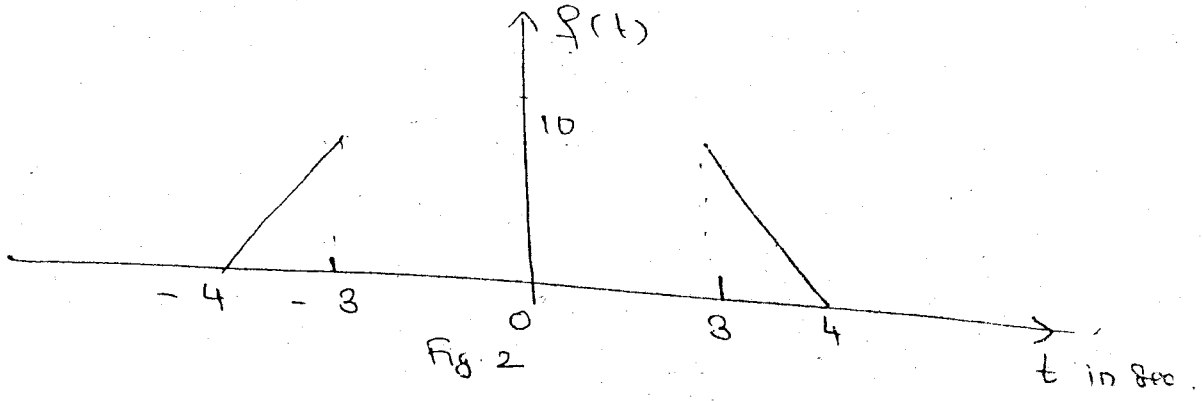

Fig 2

Q4) Find the exponential fourier series of the waveform shown in Fig. 3. Convert it to trigonometric form. Plot the spectrum.

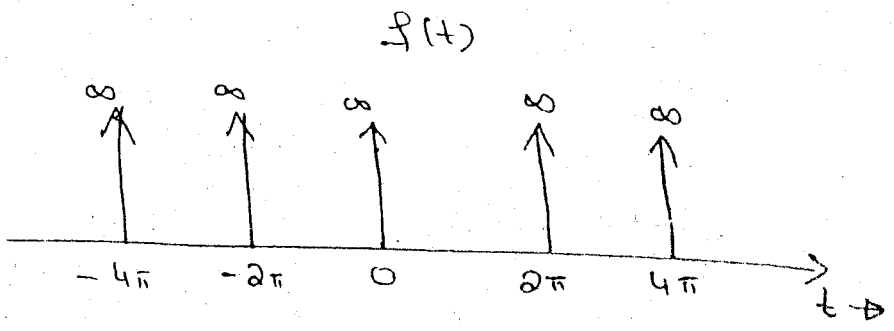

Fig 3

Q5) How do you perform graphically convolution of two signals. Explain with the example.

$$x(t) = e^{-3t}\,u(t),\ h(t) = u(t) - u(t - T)$$

Q6) (a) What is the relation between convolution and correlation?

(b) Let $X = A \cos \theta$, where A is a constant and θ is a random variable uniformly distributed over $[0, 2\pi]$. What are the mean and variance.

Section - C

(2 x 10 = 20)

Q7) State and prove the condition for orthogonality of real functions. What do you understand by a complete or closed set?

Q8) (a) State and prove the time integration property of Fourier transform.

(b) Find the Fourier transform of the pulse shown in Fig. 4.

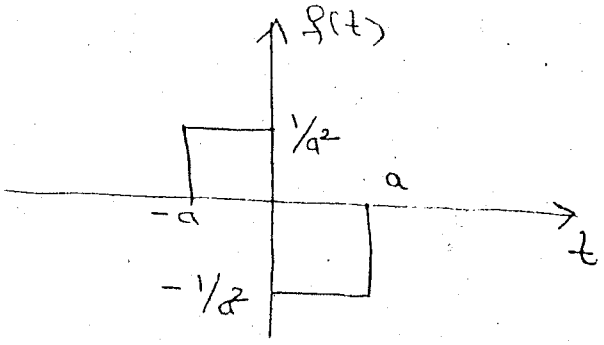

Fig. 4

Q9) (a) Derive the rms value of the noise current in an R-L circuit.

(b) Two resistors, each of 1000 ohms, are at temperatures 300°K and 400°K, respectively. Find the voltage power density spectrum at the terminals formed by the parallel combination of these resistors.

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